

Rational Inattention and Price Underreaction

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Outline

1. High-Level Overview
2. This Paper's Results

Background

Well-known back and forth in the literature:

1. Excess volatility is pervasive, especially at very high & very low frequencies [Shiller (1981); LeRoy & Porter (1981); De Bondt & Thaler (1985); Lehmann (1990); lots of stuff over intervening 20 years. . .; Augenblick & Lazarus (2018); Giglio & Kelly (2018)]
 - ▶ Campbell (2017): Equity volatility is one of three “fundamental challenges for consumption-based asset pricing models”
2. At the same time, momentum is pervasive as well!
 - ▶ Especially in the medium term and in response to firm-specific announcements

How/why??

- ▶ Point 1 interpreted as indicative of widespread overreaction
- ▶ Point 2: widespread underreaction
- ▶ Can these be reconciled?

Reconciling Over- and Underreaction

Some (excellent) work has been done writing down models to reconcile the two sets of results:

- ▶ Overreaction coupled with some form of (mental or physical) adjustment friction generates both predictions [e.g., Barberis, Greenwood, Shleifer, Jin (2018)]
- ▶ Will talk about other possibilities in a bit

For this paper, though, I want to focus on a higher-level question:

Over- or underreaction *relative to what benchmark?*

- ▶ That is, what does it mean to over- vs. underreact?
- ▶ And when can we call such behavior “rational”?

This paper will have a good answer to the second question, but want to push as well on the first.

What is Over- vs. Underreaction?

- ▶ Imagine a “biased Bayesian” updating beliefs about the likelihood of some underlying state θ given signals $s^t \equiv (s_0, s_1, \dots, s_t)$ [Augenblick & Rabin (2018)]:

$$\pi(\theta|s^t) = \frac{\mathbb{P}(s_t|\theta, s^{t-1})^\alpha \pi(\theta|s^{t-1})^\beta}{\sum_{\theta' \in \Theta} \mathbb{P}(s_t|\theta', s^{t-1})^\alpha \pi(\theta'|s^{t-1})^\beta}$$

- ▶ $\alpha > 1$: *Overreaction* to new signal relative to “correct” weight of $\alpha = 1$
- ▶ $0 \leq \beta < 1$: *Underattentiveness* (underreaction?) to prior (“base-rate neglect”)
- ▶ Note that *both* produce excess volatility of beliefs; both feature overreaction to new information *relative to prior information*
- ▶ But are they the same phenomenon? **No:**
 - ▶ $\alpha > 1$: on avg., agent has beliefs that are *too certain* (too close to 0 or 1)
 - ▶ $\beta < 1$: agent’s not certain enough [Benjamin, Bodoh-Creed, Rabin (2017)]
- ▶ What about $\alpha < 1$ and $\beta \ll 1$?
 - ▶ Underreaction to new signals, but excess belief volatility
- ▶ Starts to seem tough to disentangle over- vs. underreaction just from prices...
 - ▶ ...but risk-neutral beliefs are useful

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This Paper's Framework

Clever set of tests:

- ▶ Two-way sort of corporate bonds by “payoff relevance” of (i) interest-rate risk, (ii) credit risk
 - ▶ **Payoff relevance of risk j :** Variance of fundamental-value shocks attributable to risk j
 - ▶ Concretely: Value = $\sum_j f_j$, with $\{f_j\}$ uncorrelated mean-zero factors \implies Payoff relevance of factor f_j is σ_j
- ▶ See how long it takes each set of bonds to incorporate all new info from interest-rate shocks and credit-risk shocks
 - ▶ In particular, what fraction of 8-week bond returns are realized within 1 week in response to change in interest rates vs. change in credit risk?
- ▶ Findings:
 - (a) Higher payoff relevance for a given risk \implies quicker price reaction to that risk
 - (b) Higher payoff relevance for a given risk \implies slower price reaction to other risk (though evidence is mixed on this one)

Interpretation: Over- vs. Underreaction

$$\text{BondRet}_{i,t} = \alpha_i + \underbrace{\sum_{l=0}^7 \beta_l^{\text{stock}} \text{StockRet}_{i,t-l}}_{(1)} + \underbrace{\sum_{l=0}^7 \beta_l^{\text{Tsy}} \text{TsyRet}_{i,t-l}}_{(2)} + \varepsilon_{i,t}$$

PayoffRelevance_i^{stock} = explained sum of squares from (1)

$$\text{Underreaction}^{\text{stock}} = 1 - \frac{\hat{\beta}_0^{\text{stock}}}{\sum_{l=0}^7 \hat{\beta}_l^{\text{stock}}}$$

- ▶ Stock underreaction is lower for bond portfolios with greater payoff relevance from stocks (proxy for higher credit risk); corollary holds for interest-rate risk
- ▶ Let's return to the overview: What are we ruling in vs. out?
 - ▶ Finding: Bond prices react too little *relative to predicted eventual reaction in response to stock-return innovations*
 - ▶ But what if stock returns are also positively autocorrelated at this horizon?

Interpretation: Over- vs. Underreaction

- ▶ Finding: Bond prices react too little *relative to predicted eventual reaction in response to stock-return innovations*
- ▶ But what if stock returns are also positively autocorrelated at this horizon?
 - ▶ P. 10: *“In using these returns as shock proxies, I am relying on Treasuries and stock returns being faster to reflect interest-rate and firm-level fundamental movements. . . investors in [the] stock market should pay much more attention to firm-specific fundamental information because, being lower in the capital structure, stocks are more sensitive to firm fundamentals than corporate bonds.”*
 - ▶ Not sure this always follows. Consider Merton model: risky debt is risk-free bond minus put on firms' assets with strike equal to face value of debt; stock is call on assets with same strike
 - ▶ Put-call parity tells us that put and call with same strike have exact same price response to change in asset vol. \implies stocks and debt have exact same sensitivity to this change in default risk
 - ▶ Also know from lots of other literature [Hou & Moskowitz (2005); Asness, Moskowitz, Pedersen (2013); Bittlingmayer & Moser (2014)] that stocks exhibit momentum at medium horizon

Interpretation: Over- vs. Underreaction

- ▶ Finding: Bond prices react too little *relative to predicted eventual reaction in response to stock-return innovations*
- ▶ But what if stock returns are also positively autocorrelated at this horizon?
 - ▶ Takeaway: Bond market may be reacting “correctly” *relative to contemporaneous stock-market reaction* if stocks also take time to fully incorporate info
 - ▶ Do results survive controlling for lagged bond-market returns?
 - ▶ Either way, still finding momentum; issue is just how to interpret it
- ▶ More on over- vs. underreaction: What if investors are underreacting to market-wide info, but *overreacting* to private info (relative to Bayesians)?
[Daniel, Hirshleifer, Subrahmanyam (1998); Gennaioli, Ma, Shleifer (2018)]
 - ▶ Seems consistent with longer-term excess volatility, which Giglio & Kelly (2018) find direct evidence for in corporate CDS markets
 - ▶ And the fact that there are such high Sharpe ratios for momentum strategy, *but* that transactions costs are large enough to render these small from a trading perspective, would seem to indicate this is a market where private info is important

Interpretation: Rational Inattention

- ▶ While I'm a bit skeptical of “underreaction” framing, the rational inattention framing seems interesting and robust
- ▶ My quibbles over the past few slides are about how to interpret momentum, but *not* how to interpret relatively less momentum in response to more-relevant shocks
- ▶ Seems to me to be a nice, fairly clean test of the fact that attention allocation makes sense directionally within this market (which is dominated by institutional investors)
 - ▶ But one note: inattention that's rational doesn't preclude overattention that's irrational
 - ▶ ...especially since (I think) evidence is at least consistent with overattentiveness to private info, as on last slide

Final Notes

- ▶ What we learn from this exercise:
 1. Underreaction in bonds *relative to predicted eventual reaction* in response to stock-return (and interest-rate) innovations
 2. This response “makes sense,” in that investors do underreact less when innovations are more payoff-relevant
- ▶ Jury still out on overreaction vs. underreaction more generally, and lots of conceptual issues to sort through
 - ▶ To disentangle a bit better between different explanations, would love to know about behavior of risk-neutral beliefs (e.g., from options on corporate CDS)
- ▶ Neat paper overall